International Journal of Innovation, Creativity and Change. www.ijicc.net
Volume 13, Issue 8, 2020

Entrepreneurial Determinants of Growth of Thai Technology Firms

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It is postulated that innovative deployment of entrepreneurial activities will contribute to a firm's growth. This paper draws upon the insights on business growth from the entrepreneurship literatures to investigate the impact of the entrepreneurial determinants subsumed under the three key-based factors: entrepreneurship, innovation and firm growth dynamics, on firms' growth. It generates significant theoretical and practical implications. From a theoretical viewpoint, it expands the entrepreneurship literature by providing a detailed evaluation on the growth determinants from a developing country perspective. From a practical angle, it provides a guideline for policy formulation. Both the qualitative and quantitative methods are used to describe the determinants and test the relationships. The quantitative survey utilised data from 521 young Thai start-ups. The qualitative study comprised interviews with the CEO/owners of seven selected high-tech firms in Thailand. The findings show that the young Thai high-technology firms were similar to firms that had been examined in the literature with regard to their characteristics, innovation and firm growth dynamics, but differed in the utilisation of the key firm-based factors. The findings indicate that the competitiveness of young technology-based firms can be enhanced by developing their critical capabilities to assist the formulation and implementation of appropriate strategies to achieve better performance.

Key words: *Entrepreneurship, Innovation, Hi-technology firms, Innovative entrepreneurial activities, Growth.*

Introduction

Since the 1960s, Thailand has achieved remarkable success in economic development and was been upgraded by The World Bank from a lower-middle income economy to an upper-middle income economy in 2011 (The World Bank, 2011). The Thai economy is expected to grow by 3.9 percent in 2019 and by 3.7 percent in 2020 (Asian Development Bank, 2019).

The Global Innovation Index (2019) ranked the Thai companies' capacity for innovation 43rd out of 129 countries in 2019, based on their innovation measures, environments and outputs. However, Thailand is at risk of reverting back to a middle-income economy. It has been less successful than neighbouring countries such as Singapore and Malaysia in technological capabilities deployment. Thailand is also under competitive pressure from lower-cost emerging economies such as Viet Nam and dynamically evolving economies such as India and China. These challenges could be overcome by putting a stronger emphasis on innovation, which is the driver of economic growth (OECD, 2013). Thus, to increase competitiveness and to overcome the middle-income trap, Thailand needs to give more priority to innovation to drive productivity and prosperity (The World Economic Forum, 2016).

It has been more than ten years since the Thai government committed to positioning the country as a world leader in the technology industry through improving the infrastructure, creating a hi-tech talent pool and offering a superior business climate for all multinational technology companies. It has embarked on a new economic model called Thailand 4.0 which aims to transform Thailand into a value-based economy built on science, technology, innovation and creativity (Thailand Board of Investment, 2019). As SMEs are crucial for financial competitiveness development and employment creation (Kaliappen, 2019), the Thai government has been strengthening the Small and Medium-sized Enterprises (SMEs) development policy to sustain the enhancement of business performance of the SME (Haseeb et al., 2019) to power economic growth (Sae-Lim and Jermsittiparsert, 2019), so that SMEs will contribute more to the national economic growth. However, this policy has not been able to achieve the objective significantly. Less than five percent of the start-ups have positively contributed towards the achievement of the objective (Intrama, 2014) and new firms mostly fail within the first two years of their operation (Da Silva et al., 2019).

The establishment and growth of new firms is imperative because they are a major source of economic growth. NTBFs have the potential to fundamentally transform the ways in which societies and markets operate. They are crucial to the long term development of an economy and in this sense deserve special attention. The identification of the factors that affect their creation, survival and performance are of immediate concern. This study will identity the key firm-based factors (entrepreneurial determinants) that are associated with firms' development, to determine the extent to which these entrepreneurial determinants are constraining or assisting the growth process of young innovative high technology start-ups in Thailand.

Literature Review and Hypothesis Development

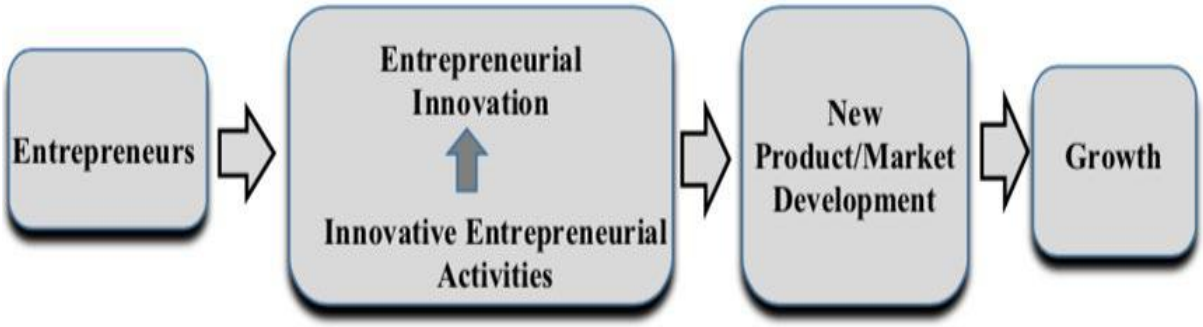
The Concept of Entrepreneurial Innovation

Voeten et al. (2011), state that entrepreneurship is a process in which people pursue their opportunities and need fulfilment through innovations. Entrepreneurship helps to generate new ideas for the economy and creates the culture of independence, risk taking and confidence. Innovation is defined as the exploitation of new markets, new business formation and new sources (Stam and Stel, 2011). Veeraraghavan (2009), stresses that innovation is a mechanism that drives business to survive and thrive.

Entrepreneurship and innovation are critical components of organisational survival and growth and in national economic evolution as the combination of innovation and entrepreneurship leads to successful businesses (Hausman, 2005; Veeraraghavan, 2009). Entrepreneurial innovation leads to technology creation, which enables the entrepreneurs to get through the technological frontier in both the developing (Naude et al., 2011) and developed (Autio et al., 2014) economies and can transform start-ups to become economically sustainable firms (Low and Isserman, 2015). It is a key factor in driving small business development (Mahemba and Bruijn, 2003). Entrepreneurship and innovation are necessary for creating new products and processes that can transform start-ups to become economically sustainable firms and can precipitate imitations that create newer innovations (Cohen, 2010) in the battle for survival.

Thus, entrepreneurs are innovators who take advantage of change by introducing new (or improved) goods, a new method of production, opening of a new market, exploiting a new source of supply and, re-engineering/organising business management processes (Ahmad and Seymour, 2008). An innovative entrepreneur is continuously looking for better ways to manage the business by simultaneously looking back and forth to the resources (combining them in new and creative ways) and to the markets (perceiving new or unmet opportunities). The entrepreneur perceives and recognises a fit between the two, a capability and process referred to as being innovating. It is predicted that the impact of being more innovative will lead to enhanced economic growth, at the firm level initially and to regional and national growth ultimately (Figure 1). In turn, this entrepreneurship-innovation-growth causal chain will create a self-reinforcing dynamic and enable a persistent growth.

Figure 1. The growth process



New *Technology Based Firms*

Broadly defined, new technology-based firms (NTBFs) are new technology ventures, commonly small, which have been described as important sources of knowledge-intensive employment and promoters of technological change and innovation in different countries (Saemundsson and Candi, 2017). NTBFs have been characterised as entrepreneurial start-ups and spin-offs from technical universities and corporations (Rydehell et al. 2019).

New technology-based firms (NTBFs) have stimulated growing interest from governments, industry and researchers, due to their perceived tremendous potential to contribute to economic development and growth. Such firms transform new scientific findings into commercial innovation, thereby strengthening the transfer of technological knowledge into the markets, securing innovation-based economic growth and generating high qualification jobs. The successful commercialisation of the NTBFs could help to convert innovative ideas into economic opportunities, generate competitiveness, create employment and increase productivity (Zapata Huamani et al. 2017). These potential effects have led to a broad interest to encourage technology-based founding activities and to provide supporting services aiming at increasing their survival prospects (Ungerer et al., 2017).

Saemundsson and Candi (2017), assert that NTBFs have been primarily preoccupied with the development of the firms' first products or services. Opportunities exploited at founding are likely to be based on founders' prior technical knowledge. Rydehell et al. (2019), state that in general, NTBFs are resource-scarce and their initial bundle of resources is not sufficient for the firms to create competitive advantages or even to progress from ideas to the commercialisation of their technologies. Consequently, NTBFs need to access resources external to the firms (Ramírez-Alesón and Fernández-Olmos, 2018), to be able to develop and commercialise their technologies, including patent activities so that they can compete with other firms. Such external resources are R&D equipment and production facilities (tangible resources), technological know-how and expertise (intangible resources). They opine that new technology-based firms (NTBFs) need to collaborate with external

stakeholders and build networks in order to acquire technical expertise and equipment to develop their technologies and innovation performance, in particular, in the early stage of firms. Business networks and firm localisation may provide NTBFs with resources which enhance the ability to develop and produce their technologies, and thus their innovation performance. In return, this could further enhance access to resources such as external financing, which could enhance young firms' success in launching new products in the market. In addition, NTBFs need to build international networks to support their innovative capacity and internationalisation for growth and gaining market share.

Key Determinants and Underlying Factor

Review of the literature has identified a range of determinants of entrepreneurial success, which include individual factors, psychological and motivational factors, social and cultural factors, and institutional factors. The strategic use of these key inputs would enhance the firm's economic growth, eventually bringing forth regional and national growth.

The key determinants that underpin the innovation process of innovative firms are presented in Table 1. They are entrepreneurial demographics, firm characteristics, skills and competencies, research and development, products characteristics, market development, financing, and internationalisation.

Table 1: Key Determinants and Underlying Characteristics

Key Determinants	Underlying Factor
Entrepreneurial Demographics	Education, Experience, Entrepreneurial founding team
Firm Characteristics	Age, Size, Ownership structure, Legal form
Skills and Competencies	Scientific knowledge, Business qualification
Research and Development	Incremental or disruptive change, R&D inputs, Customization, New or established
Product/Service Characteristics	Best-selling product/service, Product/service portfolio, Technological content of product/service, Novelty
Market Development	Number of customers, Market size, Number and type of customers, Domestic or international markets, Who is customer, Timing of first international sales
Financial of the firm	Debt, Equity, Personal inputs
Internationalization	Exporting, Export markets, Type of country sell in, Mode of international sales, Use of foreign agents

These key elements of the innovative process of growth of high technology entrepreneurship are derived from the theories on high-tech entrepreneurship from many disciplines, including economic theory of innovation, psychology, anthropology, sociology,

resource-based view, opportunity identification, behavioural management and innovation (Table 2).

Table 2: Summary of Theoretical Foundation

Theory	Main Assumptions	Theoretical Model	Relevance in Research
The economic theory of innovation	To present the understanding of economic development in the area of technological revolution	Classical Neo classical Austrian Economic theories	Neo classical brought about new movement known as Austrian Market Process for criticize market systems, entrepreneurship and completion, and market development
Psychological theory	Personality traits to define entrepreneurship, there are 2 theories; Locus of Control and the need of achievement	Locus of Control The need of achievement	Characteristics of entrepreneurs driven by creativity and innovation, and management skills. While the theory of achievement associated with the new venture creation
Anthropological theory	Study of social and cultural contexts	Social and culture contexts	Cultural environments can produce differences in entrepreneurial behaviour
Sociological theory	Study of social network, life course stage, ethnic identification and population ecology for the business	Social theory	The impact of factors of government legislation, customers, employees and competition on the survival of entrepreneurs
Resource-based theory	Predict the opportunity identification and the growth of new firms. It is composed of financial, social and human capital	Opportunity identification and the growth of new firms Financial, social and human capital	Human capital (education and experience) and financial exploit entrepreneurial opportunity and business start-up
Opportunity identification theory	Process of opportunity recognition and development includes: entrepreneurial alertness, information asymmetry and prior	Opportunity theory	Prior knowledge and experience factors are significant capabilities of a successful entrepreneur

	knowledge, social networks, personality traits and opportunity		
Behavioural theory	Examine the people's act and entrepreneurial actions	Personal action Entrepreneurial actions	Entrepreneurial action associated with the relationship with suppliers for networking and financial management
Innovation theory	Innovation theory is concerned with the economic change; innovation, entrepreneurial activities and market power	Economic change theory	Bring businesses to improve their new products and processes into market system

Hypothesis Development

This study aims to identify the key firm-based factors that are potentially associated with the long term development of hi-tech start-ups. The key research hypotheses formulated to examine the innovation input (entrepreneurial activities) contributing towards firm's growth are as follows;

Hypothesis 1: The type of establishment is related to the firm's start-up size.

Hypothesis 2: The type of establishment is related to human capital as measured by prior work experience, technical and business education qualification, number of owners and prior industry experience.

Hypothesis 3: The type of establishment is related to the firms' international market development.

Hypothesis 4: The type of establishment is related to the nature of product/service.

Hypothesis 5: The type of establishment is related to the intensity of competition.

Hypothesis 6: The type of establishment is related to the firms' innovativeness.

Hypothesis 7: The type of establishment is related to the firms' sales support.

Hypothesis 8: The type of establishment is related to the firms' internationalisation of sale.

Hypothesis 9: The type of establishment is related to the firms' production location.

Hypothesis 10: The type of establishment is related to the firms' sources of corporate finance.

Hypothesis 11: The type of establishment is related to the firms' six skills shortage in the management team.

Hypothesis 12: The type of establishment is related to the firms' performance distribution and general performance.

Hypothesis 13: The type of establishment is related to the firms' advanced technology, innovation and skills.

Hypothesis 14: The type of establishment is related to investment in new capacity.

Methodology

The quantitative questionnaire is developed based on the Anglo-German Foundation research questions (Bürgel, et al., 2001), grounded in exiting literature in the field of entrepreneurship, innovation and growth dynamics. The questionnaire is divided into six parts, Part I - General Characteristics of Respondents, Part II - Product Characteristics, Part III - International Activities, Part IV - Source of Funding, Part V- Factor Constraining Growth and Part VI - Research and Development (R&D) activities and rating of their innovation situation, including their future plan with a total of 47 questions.

A total of 521 start-ups from the 2000 firms surveyed were selected. Altogether there were eight categories of firms by type of establishment. The distribution by type of establishment is presented in Table 3.

Table 3: Frequency Distribution of Types of Start-ups Based on Establishment

Types of establishment	**Number of observations**
merger with a similar sized firm	138
merger with a larger firm	136
Independently established firm	93
acquisition of another firm in your industry sector	33
acquisition of another firm outside your core industry sector	25
management buy-out or management buy-in	22
change of ownership	24
change of management	26

Of the eight types of establishment, three types of establishments which are: (1) firms established by merging with a larger firm, (2) firms established by merging with a similar firm, and (3) firms established independently, 367 in total, accounted for about 70% of the total number of firms participating in the survey. The remaining six types of establishments, 154 in total, accounted for 27% of the firms used. As these six types of establishments were too small in number to be statistically practical for use individually in the analysis, they were combined to form the 'other' establishment type. Though the 'other' type is part of the analysis, it will be excluded in the discussion because it is not possible to meaningfully attribute the implications derived from the analysis to this group, as it consisted of six distinctly different types of firms.

The qualitative face-to-face interviews were conducted with seven hi-technology start-ups by using the same question structure used in the telephone survey. The research themes further examined during the interviews included: entrepreneurial characteristics, skill competencies, the technological strategy, both research and development (R&D) and innovation strategy, product development, the extent of market development and international business activities, financial business, and possible factors assisting or constraining the growth of firms.

The univariate, bivariate and multivariate analytical procedures are used to analyse the data collected in this research. The univariate descriptive procedure is used to describe the data collected to provide a profile of the characteristics of the respondents. The Poisson and Probit Regression Analysis are used to explore the relationship between each of the contigent varibles subsumed under the eight key firm-based factors and the types of establishment at founding.

Data Analysis and Findings

Descriptive Analysis of Company Characteristics

The descriptive analysis of the 521 usable questionnaires collected from the 2,000 young hi-technology firms in Thailand using telephone surveys provides the basic profile of the respondents. The finding of the general description of the core characteristics of the firms are:

Establishment Types*:* Less than one in five new firms could be considered as independent, de novo start-ups. The majority of the new technology start-ups in Thailand were formed through mergers and acquisitions amongst existing firms. The typical technology firm had between three to four owners, although the ownership team members could be 16 at the extreme. The ownership team of 68% of the firms had not changed since their formation. Of those that did undergo an ownership change, the overall control remained with the founding owners in the majority of cases.

Initial Employment at Start-Up*:* The median employment number at start-up stage was 11, which is classified as above the micro firm cut-off point of nine employees, but within the small firm class size range (10-49 employees). The independent start-ups were on average significantly bigger than start-ups arising from mergers between or acquisition of existing firms.

Human Capital*:* Thai technological start-ups had a very high concentration of technically educated employees, with more than 80% of the total workforce having a higher level technical qualification. In contrast, more than 60% of the managers had no industry specific experience. The lack of industry specific experience was particularly evident in the independent start-ups. However, virtually all managers had a business qualification. This

suggests that, at the managerial level, general nature human capital is the dominant form rather than specific human capital.

Product Characteristics and Innovation*:* Most of the firms had already developed 'best-selling' products or services on formation and depended on a single product or service line. Most of the products or services were of the intermediate type. Though business customers were the most important, all three types of customer group (business, consumer, government) were important customers for the start-ups to sell their products or services.

Market Development and Internationalisation*:* Half of the firms claimed that competition was strong and more than one fourth of them engaged in intense competition. The competitors offered their competitive product/service or a lower price product into the market within one year. All the typical sales support activities, such as Technical consultation prior to sales; Individual client customisation; Specific configuration or system requirements; Complex or time consuming installation; Regular maintenance and upgrade; Specialised training required for front-line and sales personnel were regarded as very important. They mainly competed in the domestic market rather than engaged in international sales activities. During the early stage, Thai start-ups also mainly produced their products/services within the country.

Source of Finance*:* Personal equity was generally used to start the business and retained profits were used later after the business had generated income/revenue. Important sources of finance were mostly internal finance and short bank loans.

Testing of Hypothesis

The objective of the regression analysis is to explore the relationship between each of the contigent varibles subsumed under the eight key firm-based factors listed below and type of establishment:

1) Ownership, governance and firm demographic
2) Characteristics of product/services and markets
3) Innovation
4) Internationalisation
5) Production location
6) Source of finance
7) Skills shortage within management team
8) Performance indicators

The summary of the results of the regression analysis examining the hypotheses stating a positive relationship between the key firm-based contingent factors and types of establishment are presented in Table 4.

Table 4: Summary of Hypotheses of Testing

Key domain	*Key-firm based factor*	*Hypothesis*	*Supported*
Entrepreneurship	**Ownership, governance and firm demographic**	H1 - size of firms	No
		H2 – human capital	Yes
Innovation	**Characteristics of product/services and markets**	H3 - developed for international market	No
		H4 - nature of product/service	Yes
		H5 - intensity of competition	No
	Innovation	H6 - innovativeness	No
		H7 - sales support activities	Yes
Firm growth dynamics	**Internationalization**	H8 - internationalization	No
	Production location	H9 – production location	No
	Source of finance	H10 - source of finance	Yes
	Skills shortage within management team	H11 - shortage skills wihtin management team	Yes
	Performance indicators	H12 - performance distribution and general performance	Yes
		H13 - advance technology, innovation and skills	No
		H14 - investment in new capcity	No

Entrepreneurship (Ownership, Governance and Firm Demographic)

The analysis has shown that the type of establishment was not associated with the size of the firm at the founding stage. This suggests that the size of the firm is not associated with the survival and growth of the business, as is expounded by Gibrate's law (Relander, 2011). The size of the management team was a significant differentiating factor. The findings suggested that the larger firms intentionally employed a higher number of managerial staff with a technical/science and business education than the independent new firms. The size of the founding ownership team is a measure of the collective human capital (technical skills and business education qualification, and prior work experience) in the firm. A smaller ownership team may improve the team's clarity on objectives, it may also negatively impact the potential for survival and future growth. The technical aspects of human capital are

particularly important in the technological context and, more broadly, in relation to innovative capacity and capabilities (Colombo and Grilli, 2007).

Innovation (Characteristics of Product/Services and Markets)(Innovation)

Innovation is broadly defined as 'development of new product, process, new sources of supply, the exploitation of new markets and the development of new ways to organise business' (Szirmai et al., 2011, p. 5). The results show that internationalisation of products/services when they were commercialised was not a differentiating factor. This suggests that most firms did not develop their products with the intention to sell abroad at founding.

The nature of the product/service was found to be positively related to the type of establishment. The importance of a product's technological content characteristic has been established. Burgel et al. (2000), claim that the technological sophistication of a product probably influences the growth rate of hi-tech start-ups. Economic theory considers how material resources are transformed into products and services (Murphy et al., 2006). As propounded by the resource-based view theory (RBV), this transformation process involves innovation that will help the entrepreneur to access more resources and opportunity for firm growth (Alvarez and Busenitz, 2001). The firms generally produced intermediate goods for the domestic market. This could be because they needed their products to rapidly reach the market in order to be profitable, to cover the high cost of R&D and to address the short product life-cycle of hi-tech products (Saemundsson and Dahlstrand, 2005).

The analysis shows that intensity of competition was not a differentiation factor. This suggests that all start-up firms are equally likely to face competition in Thailand. The advent of the ASEAN Economic Community (AEC) will have a big impact on these firms. Information about regulations in AEC countries was still lacking. They feared the introduction of similar products by international competitors.

Innovativeness was not significantly related to type of firm establishment. Different types of establishments used different innovative approaches. For instance, IT businesses and skincare and cosmetic manufacturers used incremental change to innovate the production of their products and services. By contrast, engineering companies used the 'disruptive change of technology' approach to develop their core technology to produce their products. In general, the firms' innovation was based on the use of existing technology. Cala et al. (2015), assert that in developing countries, small, new firms do not enjoy an innovative advantage by incorporating new technical progress. Small, new firms mainly innovate by imitating or incorporating knowledge developed by other organisations. Thus, innovative entry is an infrequent phenomenon in contrast with advanced countries.

The factor 'Sales support activities' was significantly related to the type of establishment. The interview protocol shows there existed a very strong competitive force in the market because the rivals introduced their competitive products at lower prices in the market within the first year of the launch of a product. The firms employed after sales service as a tool to retain customers and sustain sales. Nalintippayawong et al., (2018), find that factors such as customer satisfaction, business credibility, and product appreciation greatly affect customer perspective and directly affect market opportunity. Engaging after sales services extensively would enhance customers' satisfaction and perception. In addition, a business with a positive image will induce brand loyalty in customers, attract new customers, and increase the business stability.

Firm Growth Dynamics (Internationalisation) (Product Location) (Source of Finance) (Skills within Management Team) (Performance Indicators)

The development of products/services for selling abroad is important for business survival and growth of new enterprises (Abdullah and Zain, 2011). New western firms which focus more on selling abroad grow more than those firms which sell only domestically (Bürgel et al. 2000). Despite the importance of internationalisation, there was no significant link found between type of establishment and internationalisation. While all the Thai young start-ups aspired to internationalise their markets, as early internationalisation would bring distinct advantage to the firms (Koch, 2017), most Thaihigh-technology firms focused on domestic markets initially. This could be the results of the financial constraints encountered in the start-up stage, as was revealed by the firms and a consequence of the cost of doing business overseas (Chaplin, 2013).

The analysis revealed that there was no significant link between type of establishment and production location. Networking was opined to be important by the firms. Technological changes could be facilitated by the clustering of development and innovation facilities (Frenkel, 2001). Toppinen (2011), argues that networking creates new channels and new opportunity identification. Collaboration among firms can provide easy access to information and technology and acquisition of skills and knowledge through joint training or research and risk-sharing (Murphy, 2002). The formal alliances improve new product development and marketing activities (Doyle, 2000).

Source of finance was found to be positively related to type of establishment. Thai high-tech start-ups faced difficulty in securing external financing and depended on personal funds and short-term bank loans as the main sources of finance to set up the business. Retained profits were used later to finance growth after the business had started to generate surplus revenue. The findings also indicate that financial bootstrapping is a common strategy use for financing

the business (Ajagbe et al., 2015; Ajagbe et al., 2016; Baldock et al., 2015; Wilson, 2015; Cotei and Farhat, 2017; Hechavarria, 2016; Wille and Miller, 2017; Wonglimpiyarat, 2015). In addition, start-ups created from a merger of similar sized firms and those created through an ownership change also tapped short and long-term loans, venture capital, and other external sources. There was no significant variation in the use of director loans by all types of firms.

A shortage of skills was found to be a differentiating factor among the different establishment types. Skilled employees and managerial experiences are crucial factors, because without them it would be very difficult to run the business efficiently. The management team with superior skills will bring extraordinary advantages to the firm (Song et al., 2008), because a broad range of skills in both managerial and technical possessed by the management team could contribute to the firm's success and growth (Kakati, 2003; Oakey, 2003) and broaden the long-term survival of the business (Oakey, 2003). Bygrave (2009), highlighted that prior marketing/commercial knowledge and experience are important for entrepreneurial venture development. On the other hand, lack of commercial knowledge and experience could be a cause factor of failure in business (Park, 2005).

Eight performance indicating factors, developing international markets, developing new products/services, investment in human capital, access to skilled staff, collaboration with other businesses, collaboration with other organisations, innovation, ease of accessing investment were tested. Generally, start-ups have scarce resources and thus, need to make choices amongst competing activities and investments. Of the eight indicators examined, only three of them, investment in human capital factor, the access to skilled staff factor and ease in accessing investment factor were found to be not significantly related with the types of establishment. A possible explanation is that the start-ups had managed to utilise other strategies to circumvent them. It was found that some of them relied on part-time employees to help manage the production. The general firm performance did not vary significantly across different types of start-ups. This suggests that the different types of start-ups appeared to achieve their overall outcomes through different paths. Overall, these performance factors presented a significant impact on the possibility to achieve business survival and growth.

The ability to access advanced technology, innovation and skills at the founding stage did not have a significant correlation with type of establishment. There was no significant association between type of establishment with the level of investment in a new capacity and current relative investment benchmark position as well.

In summary, all the core firm growth determinants that have been examined, to a certain extent, were significantly associated with the young high-technology firms in Thailand.

Almost all the innovative inputs are regarded as important factors by the entrepreneurs in the high-tech start-ups.

Discussion and Conclusion

The aim of this study is to identity the key firm-based factors that are associated with the long term growth of young Thai high-technology.

The regression analysis has shown that, to a great extent, the young high-technology firms in Thailand were similar to other firms that have been examined in the literature with regard to their characteristics, innovation and firm growth dynamics, but different with regard to the utilisation of the sub-factors subsumed under the three key-based factors, entrepreneurship, innovation and firm growth dynamics. The outcomes of the testing of the hypotheses indicate that, to a certain extent, the nature and developmental strategies of the young high-technology firms in Thailand were similar to that propounded by the core theories. However, contrary to the assertions made by the core theories, which claim that young firms would use the inputs positively to achieve growth, the use of some of these inputs is significantly reduced by certain types of establishments. This seems to suggest that different establishment types may utilise different inputs to strategically circumvent the shortages or obstacles encountered to survive. For example, in order to successfully sell a product/service, the merger with a large firm offered individual client customisation to support the sale activities. They produced their product/service for selling abroad at the initial stage. Whereas the merger with similar sized firms used specialised training to equip the front-line and sales persons to increase sales.

At the start-up stage, survival was of the greatest importance to all the firms. Hi-tech firms need to launch products to a larger market in order to cover the high cost of R&D, to address the short product life-cycle of hi-tech products, and to rapidly reach the domestic markets in order to be profitable (Saemundsson and Dahlstrand, 2005), but generally, face challenges in producing their highly innovative goods to serve national and international markets (Ganotakis and Love (2010). Pursuing innovations leads to riskier, more complicated, and less linear start-up processes (Samuelsson and Davidsson, 2009). Owners may encounter obstacles related to technological advancement and marketing systems (Maine and Garnsey, 2006) and incur a higher initial cost while introducing new products to the market, as the innovation takes a long period of time to complete (Oakey, 2003; Saemundsson and Dahlstrand, 2005). SME start-ups need to focus on their sustainability and growth during the early start-up stage. To be sustainable, firms must firstly, accumulate productive resources, then deliver more innovation outputs that will enable the firm to develop new markets or compete more effectively in existing markets. In turn, this entrepreneurship-innovation-growth causal chain will create a self-reinforcing dynamic, enabling a persistent growth in a unique and highly entrepreneurial and innovative firm.

In conclusion, the Thai young start-ups not only contribute directly to the national GDP but also serve as a catalyst for economic growth by producing intermediate goods which are the feed-stock for the final goods manufactured by their business customers.

Implication and Future Research

This study has several significant policy implications for the policy makers in Thailand. Firstly, it is important to have a broader formalised system that is capable of remedying the financial constraints faced by the entrepreneurs of small firms at the different stages of the lifecycle as a consequence of the impact of their cultural practices. Mechanisms such as 'Business Matching' and Business accelerators/bootcamps are potential vehicles for overcoming the difficulty to secure financial malaise faced by new technology based firms. It assists the business not only to bridge the financial gap but also to embark on market development through building relationships between Thai and foreign enterprises (Krungsriguru, 2019; Satitthammajit, 2016; Soonthonsmai, 2018). This will enable the start-ups not only to enter international markets but also to promote entrepreneurial development within the firms (Soonthonsmai, 2018). Secondly, policies based on evidence from developed countries may not be suitable for developing countries. Models developed for large firms do not necessarily apply to SMEs. Small firms have been found, for instance, to differ in their competitive behaviour from large firms, which has important implications for their performance and growth. Finally, this study also aims to address the question of whether the determinants of entrepreneurship are the same and/or have the same impact in developed and developing countries. The analysis leads to the conclusion that, in general, young Thai start-ups are facing similar challenges faced by the other young start-ups in developed countries, but in a different manner. The impact of the key firm-based factors on the growth of these start-ups varied from that reported in previous studies.

The young Thai start-ups are found to respond to the key firm-based factors innovatively and strategically in order to circumvent the constraints encountered to foster growth. To provide future researchers with a more comprehensive comparison among countries, it may be important that this strategic behaviour is studied further to see whether these findings will hold in other Asian countries, where the environment is diverse and dynamic, so that the knowledge gained could be used to enhance the growth of new start-ups in general.

REFERENCES

Abdullah, N. A. H. N., & Zain, S. N. M. (2011). The internationalization theory and Malaysian small medium enterprises (SMEs). *International Journal of Trade, Economics and Finance, 2*(4), 318.

Ahmad, N., & Seymour, R. G. (2008). *Defining Entrepreneurial Activity. Definitions Supporting Frameworks for Data Collection.* OECD Statistics Working Papers 2008 (01).

Ajagbe, M.A., Isiavwe, D. T., Mercy Ogbari, E. I. & Sholanke, A. B. (2015). Financing Early Staged Technology Based Firms in Malaysia. *Research Journal of Finance and Accounting,* 6(4), pp.210-221.

Ajagbe, M. A., Olujobi, J. O., Uguimoh, A.A. , Okoye, L. U., & Oke, A. O. (2016). Technology Based Entrepreneurship Financing. Lessons for Nigeria, *International Journal of Academic Research in Accounting, Finance and Management Sciences,* 6 (1), pp. 150–163.

Alvarez, S. A., & Busenitz, L. W. (2001). The entrepreneurship of resource-based theory. *Journal of management, 27*(6), 755-775.

Asian Development Bank (2019). Economic indicators for Thailand. *Asian Development Outlook 2019*, [online], available at:: https://www.adb.org/countries/thailand/economy

Autio, E., Kenny M, Mustar P, Siegel D, Wright M. (2014). Entrepreneurial innovation: The importance of context. *Research Policy*, 43/7, pp.1097-1108.

Baldock, R., North, D. and Ullah, F. (2015). The Impact of the Financial Crisis on the Financing and Growth of Technology-Based Small Firms: Some Survey Evidence from the United Kingdom. *New Technology-Based Firms in the New Millennium, 11*, 201-226.

Bürgel, O., Fier, A., Licht, G., & Murray, G. (2000). *Internationalisation of high-tech start-ups and fast growth-evidence for UK and Germany*, ZEW Discussion Papers.

Bürgel, O.; Murray, G. & Fier, A; & Licht, G., (2001). *An Anglo-German Foundation for the Study of Industrial Society Report.* The Rapid Internationalisation Of High Tech Young Firms In Germany And The United Kingdom.

Bygrave, W.D. (2009). *The Entrepreneurial process, in: Bygrave, W.D. and Zacharakis, A. (eds.)*, The Portable MBA in Entrepreneurship, [e-book], 4th ed., Hoboken, NJ: John Wiley & Sons, Inc.

Calá, C., Arauzo Carod, J. M., Antolín, M., & Miguel, C. (2015). *The Determinants of Entrepreneurship in Developing Countries.* Universitat Rovira i Virgili, Department of Economics

Chaplin, H. (2013). *An investigation of the barriers to internationalisation faced by young technology intensive firms.* New Technology-Based Firms in the New Millennium (New Technology-Based Firms in the New Millenium, Volume 10), Emerald Group Publishing Limited, 33-52.

Cohen, W. M. (2010). Fifty years of empirical studies of innovative activity and performance. *Handbook of the Economics of Innovation,* 1, 129-213.

Colombo, M. G., & Grilli, L. (2007). Funding gaps? Access to bank loans by high-tech start-ups. *Small Business Economics, 29*(1-2), 25-46.

Cotei, C. & Farhat, J. (2017). The Evolution of Financing Structure in U.S. Startups, *Journal of Entrepreneurial Finance,* 19(1), 1-32.

Da Silva, F. R., Fabrício, R., da Silva, P. R., Galegale, N. V., & Kabane, G. K. (2019). Why technology-based startups fail? An IT management approach. *In Production and Operations Management Society, POMS 26th Annual Conference,* Washington.

Doyle, G. M. (2000). Making Networks Work: A Study of Best Practice in Business-led Networks and the Lessons for Ireland from Abroad. A Skillnets Report.

Frenkel, A. (2001). Why high-technology firms choose to locate in or near metropolitan areas. *Urban Studies, 38*(7), 1083-1101.

Ganotakis, P., & Love, J. H. (2010). R&D, product innovation, and exporting: evidence from UK new technology based firms. *Oxford Economic Papers, 63*(2), 279-306.

Haseeb, M., Hussain, H. I., Ślusarczyk, B., & Jermsittiparsert, K. (2019). Industry 4.0: A solution towards technology challenges of sustainable business performance. *Social Sciences, 8*(5), 154.

Hausman, A. (2005). Innovativeness among small businesses: Theory and propositions for future research. *Industrial Marketing Management, 34*(8), 773-782.

Hechavarría, D.M., Matthews, C.H. & Reynolds, P.D. (2016). Does start-up financing influence start-up speed? Evidence from the panel study of entrepreneurial dynamics. *Small Business Economics,* 46(1), 137–167.

Intrama, V. (2014). Business Start-Up Factors and Innovation Strategies Case Study: Hi-Tech SME in Thailand. *International Journal of the Computer, the Internet and Management, 22(1), 53-61*

Kakati, M. (2003). Success criteria in high-tech new ventures. *Technovation, 23*(5), 447-457.

Kaliappen, N., Nu'Man, A., & Jermsittiparsert, K. (2019). The Mediating Role of Learning Orientation in the Relationship between Organizational Innovativeness, Financial Performance, Production Performance and Marketing Performance of SMEs in Thailand. *International Journal of Innovation, Creativity and Change,* 6(11), 19-40.

Koch, M. (2017). *Tech Start-up Internationalisation : Development of an internationalisation model for born global web-based tech start-ups from European start-up hubs.* KTH Royal Institution of Technology.

KrungsriGuru, (2019). Business Matching. Bangkok, [online], available at: https://www.krungsri.com/bank/th/plearn-plearn/business-matching.html.

Low, S. A., & Isserman, A. M. (2015). Where are the innovative entrepreneurs? Identifying innovative industries and measuring innovative entrepreneurship. *International Regional Science Review, 38*(2), 171-201.

Mahemba, C. M., & Bruijn, E. J. D. (2003). Innovation Activities by Small and Medium-sized Manufacturing Enterprises in Tanzania. *Creativity and Innovation Management, 12*(3), 162-173.

Maine, E., & Garnsey, E. (2006). Commercializing generic technology: the case of advanced materials ventures. *Research Policy,* 35(3), 375-393.

Murphy, M. (2002). Organisational change and firm performance. *OECD Science, Technology and Industry Working Papers,* 2002/14, OECD Publishing.

Murphy, P. J., Liao, J., & Welsch, H. P. (2006). A conceptual history of entrepreneurial thought. *Journal of Management History, 12*(1), 12-35.

Nalintippayawong, S., Waiyawatpattarakul, N., & Chotipant, S. (2018, July). Examining the Critical Success Factors of Startup in Thailand Using Structural Equation Model. In *2018 10th International Conference on Information Technology and Electrical Engineering (ICITEE)*, 388-393. IEEE.

Naudé, W., Szirmai, A., & Goedhuys, M. (2011). *Innovation and entrepreneurship in developing countries.* UNU.

Oakey, R. (2003). Technical entreprenenurship in high technology small firms: some observations on the implications for management. *Technovation,* 23(8), 679-688.

OECD. (2013). *Entrepreneurship and Local Economic Development: Programme and Policy Recommendations*. Paris: OECD.

Park, J. S. (2005). Opportunity recognition and product innovation in entrepreneurial hi-tech start-ups: a new perspective and supporting case study. *Technovation,* 25(7), 739-752.

Ramírez-Alesón, M., & Fernández-Olmos, M. (2018). Unravelling the effects of Science Parks on the innovation performance of NTBFs. *The Journal of Technology Transfer*, 43(2), 482-505.

Relander, P. (2011). *Gibrat's law revised: A study on Gibrat's law with models of industry dynamic*. Unpublished Master's thesis, Alto University, Finland.

Rydehell, H., Isaksson, A., & Löfsten, H. (2019). Business networks and localization effects for new Swedish technology-based firms' innovation performance. *The Journal of Technology Transfer*, 44(5), 1547-1576.

Sae-Lim, Patipan & Jermsittiparsert, Kittisak. (2019). Is the Fourth Industrial Revolution a Panacea? Risks toward the Fourth Industrial Revolution: Evidence in the Thai Economy. *International Journal of Innovation, Creativity and Change*, 5(2), 732-752.

Saemundsson, R. J. & Candi, M. (2017). Absorptive capacity and the identification of opportunities in new technology-based firms. *Technovation,* 64-65, 43-49.

Saemundsson, R., & Dahlstrand, Å. L. (2005). How business opportunities constrain young technology-based firms from growing into medium-sized firms. *Small Business Economics,* 24(2), 113-129.

Samuelsson, M., Davidsson, P., (2009). Does venture opportunity variation matter? Investigating systematic process differences between innovative and imitative new ventures. *Small Bus. Econ.* 33, 229–255.

Satitthammajit, K. (2016). Business Matching: The Success Model to enter the Chinese Market. Bangkok: Department of International Economic Affairs, [online], available at: http://www.mfa.go.th/business/th/articles/ 88/14422-Business-Matching:-สูตรสำเร็จในการบุกเบิกตลาดจีน?.html.

Song, M., Podoynitsyna, K., Van Der Bij, H., & Halman, J. I. (2008). Success Factors in New Ventures: A Meta-analysis. *Journal of product innovation management,* 25(1), 7-27.

Soonthonsmai, V. (2018). Potentiality of collaboration for Thai new S-Curve industries on business matching. *Modern management Journal,* 16 (1), 1-9.

Stam, E., & van Stel, A. (2011). Types of entrepreneurship and economic growth. *Entrepreneurship, innovation, and economic development*, 78-95.

Szirmai, A., Naudé, W. A., & Goedhuys, M. (2011). *Entrepreneurship, innovation, and economic development:* Oxford University Press.

Thailand Board of Investment (2019). Thailand's advantage, [online], available at: http://www.boi.go.th.

The World bank (2011). Thailand Economic Monitor: Thailand now an upper middle income economy, [online], available at: http://data.worldbank.org

The Global Innovation Index (2019). Creating healthy lives-the future of medical innovation, [online], available at: http://wwww.globalinnovationindex.org/Home.

The World Economic Forum (2016). The Global Competitiveness report 2016-2017, [online], available at: https://www.weforum.org.

Toppinen, A., Lähtinen, K., Leskinen, L. A., & Österman, N. (2011). Network co-operation as a source of competitiveness in medium-sized Finnish sawmills. *Silva Fennica,* 45(4), 743-759.

Ungerer, C., König, Marc, Baltes, Guido & M Maki, Kanetaka. (2017). *On the Interconnectedness of Value Network Maturity and New Technology-Based Firm Survival.* Conference: 23rd ICE/IEEE International Technology Management Conference, 27-29 2017, Madeira, Portugal.

Veeraraghavan, V. (2009). Entrepreneurship and Innovation. *Asia-Pacific Journal of Management Research and Innovation, 5*(1), 14-20.

Voeten, J., deHaan, J., & deGroot, G. (2011). Can Small Firms Innovate? The Case of Clusters of Small Producers in Northern Vietnam. *Entrepreneurship, innovation, and economic development,* 96.

Willie, D., Hoffer, A. and Miller, S. (2017). Small-business financing after the financial crisis – lessons from the literature, *Journal of Entrepreneurship and Public Policy*, 6(3), 315-339.

Wilson, K. E. (2015). Policy Lessons from Financing Innovative Firms. *OECD Science, Technology and Industry Policy Papers,* No. 24, OECD Publishing, Paris.

Wonglimpiyarat, J. (2015). *Financing innovative businesses toward commercialization*. Technology Financing and Commercialization, pp.50-57, London: Palgrave Macmillan.

Zapata Huamani, G. A., Fernandez Lopez, S., Neira Gomez, I. and Rey Ares, L (2017). The role of the entrepreneur in new technology-based firms (NTBFs): An analysis according to contex development, Regional and Sectoral Economic Studies*, Euro-American Association of Economic Development*, 17 (2), 25-42.